Ethernet

· 8-bit · 16-bit

Installation Manual

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• 8-bit •16-bit
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Fifth Edition, May 1991

FCC Warning

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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Chapter 1. Introduction

Overview

The Ethernet network is a high performance, industry standard local area network (LAN) for IBM PC/XT/AT/386 or compatible allowing users on the network to communicate with each other, and share peripheral devices such as disks, printers, ...etc.

The Ethernet network card features a high data transmission rate of 10 mega bits per second, employs the IEEE 802.3 standard, and uses the CSMA/CD (Carrier Sense Multiple Access with Collision Detection) protocol and the linear bus topology, which all network stations tap onto a single line of coaxial cable.

The Ethernet network can be flexibly configured as Cheapernet configuration using thin coaxial cable for short-distance network, and Ethernet configuration using thick coaxial cable for long distance network.

The Ethernet network card offers two types of boards: 8-bit and 16-bit Ethernet cards. Both cards fully support Novell's NetWare network operating systems. The 8-bit Ethernet card, compatible with Novell's NE1000 Ethernet interface board, can be installed into one of the expansion slots inside an IBM PC/XT/AT/386 or compatible. The 16-bit Ethernet card, fully compatible with Novell's NE2000 Ethernet interface board, can be

inserted into one of the 16-bit expansion slots inside an IBM PC/AT/386 or compatible, providing faster and more efficient data transfer between the PC host and the network.

However, the 16-bit Ethernet may also be inserted into an 8-bit expansion slot and operates as the 8-bit Ethernet card.

Features

- Half-sized 4-layer board
- IEEE 802.3 Industry Standard
- High Performance 10 Mega Bits/Sec. Data Transmission Rate
- Flexible Configuration: Cheapernet (Thin Cable) with On-Board Transceiver; Ethernet (Thick Cable) with External Transceiver
- 8-bit Ethernet: Fully Compatible with Novell's NE1000 Ethernet Boards
- 16-bit Ethernet: Fully Compatible with Novell's NE2000 Ethernet Boards
- Fully Support Novell's NetWare network operating Systems
- 8-bit Ethernet: 8K RAM Buffer
  16-bit Ethernet: 16K RAM Buffer
- Socket for Remote Boot ROM
- Interrupt Request (IRQ)Lines Selectable: 2, 3, 4, 5
- Base Input/Output Address Selectable: 300H, 320H, 340H, 360H
- Remote Boot ROM Address Selectable: C000H - DFFFH

Specifications

• **Protocol**	CSMA/CD (Carrier Sense Multiple Access with Collision Detection)
• **Topology**	Distributed Bus
• **Data Rate**	10 Mega Bits/Sec.
• **Computer**	IBM PC/XT/AT/386 and Compatibles
• **Network Interface**	IEEE 802.3 Standard
• **Cable**	Thin RG-58 A/U Coaxial Cable (Cheapernet Configuration) Thick Coaxial Cable (Ethernet Configuration with External Transceiver)
• **Network O.S.**	Novell NetWare
• **Distance**	*Thin-Cable network (Cheapernet Configuration)* 1,000 Meters (3,300 Feet) with Repeater 200 Meters (660 Feet) without Repeater

	Thick Cable Network (Ethernet Configuration) 2,500 Meters (8,250 Feet) with Repeater 500 Meters (1,650 Feet) without Repeater
• **Nodes Per Segment**	30
• **Power**	+5 Volts at 1 A Maximum
• **Temperature**	Operating: 0° to 45°C Ambient Storage: -40° to 70°C
• **Humidity**	50% to 95% RH (Relative Humidity) Non-Condensing at 40°C

Terms and Notations

The terms and notations used in this manual are detailed below. To avoid confusion over the definitions and usage of certain terms, which may differ from those used in other manuals, all specialized technical vocabulary is redefined. These definitions will be followed throughout this manual except where otherwise stated.

Barrel Connector

This a female/female connector, which can be used to connect two lengths of cable, or the cable end connectors both being male. The Barrel Connector can have two types: BNC Barrel Connector for thin cable, and N-Series Barrel Connector for thick cable.

BNC Male Connector

BNC male connectors are installed at both ends of thin cable lengths.

Cheapernet Configuration

This is a flexible configuration of an Ethernet network which employs on-board transceiver, BNC connectors, and RG-58 A/U thin coaxial cable.

Coaxial Cable

The kind of cable is used for the network trunk cables, and consists of several concentric layers. The coaxial cable for Ethernet network is available in two types: thin and thick cable. The Cheapernet thin cable is 0.2-inch diameter RG-58 A/U 50-Ohm coaxial cable, which is less expensive than the Ethernet thick cable that is 0.4-inch diameter 50-Ohm coaxial cable.

DIX Connectors

The DIX Connectors are used on the thick cable network. A DIX female connector is mounted on a network board. A DIX male connector and a DIX female connector are installed at either end of the transceiver cable. The DIX male connector (with several small pins) can connect to the network board, and the DIX female connector is to connect to an external transceiver which has a DIX male connector mounted.

Ethernet Configuration

This is a conventional configuraiton of an Ethernet network which employs external transceiver, N-Series connectors, and thick coaxial cable.

Ethernet Repeater

This is a device to connect two segments of network trunk cable together. Thus every two segments in a network must be connected using an Ethernet Repeater.

LAN

Local Area Network

N-Series Male Connector

N-Series male connectors are installed at both ends of thick cable.

Node

Another name for a station, workstation, or PC, that is incorporated into a network.

Section

The length of cable between any two stations in a network.

Segment

A length of cable that consists of a numer of sections connected together, and ending at each end with a terminator.

Tee-Connector

The BNC connector that plugs into a network interface card or an Ethernet Repeater, and is then connected directly with the cable.

Terminator

A small device that must be attached to both ends of every segment of a network. A 50-Ohm coaxial terminating resistor is usually used as a Terminator which is installed at each end of every segment. The terminators are available in two types: BNC terminator for thin cable, and N-Series terminator for thick cable.

Thick Cable

The thick cable is 0.4-inch diameter 50-Ohm coaxial cable with N-Series male connectors installed at both ends. It is mainly used in the Ethernet-configuration network.

Thin Cable

The thin cable is 0.2-inch diameter RG-58 A/U 50-Ohm coaxial cable with BNC male connectors installed at both ends. It is mainly used in the Cheapernet-configuration network.

Transceiver

The external transceivers are required only when the thick cable is used. The transceiver can transmit and receive data, detect collision, and provide electrical isolation between the network and the PC equipment.

Transceiver Cable

The transceiver cable is used to connect a network interface card of a station to an external transceiver in a thick cable network.

Trunk Cable

The main cable that makes up a network is used as a common bus line, and connects one station with another.

Chapter 2. Setting the Ethernet Cards

The Ethernet cards are available in two types of boards: 8-bit Ethernet card and 16-bit Ethernet card, according to the data bus width.

This chapter describes how to set up the following hardware parameters for the 8-bit Ethernet card and 16-bit Ethernet card.

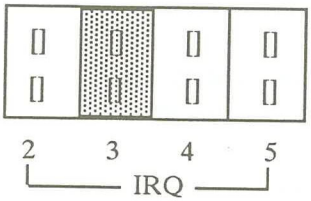
- Interrupt Request (IRQ) Lines
- Base Input/Output Address
- Remote Boot
- Connector Type
- AT Bus Compatibility (16-bit Etherent card only)

The 8-bit/16-bit Ethernet card contains:

- one 4-position jumper for IRQ setting
- one 6-position jumper for base I/O address and remote boot settings
- one 7-position jumper for connector type setting

Interrupt Request Lines (IRQ)

There are four jumper positions (labeled **IRQ 2 3 4 5**) on the card which are used to select IRQ 2, 3, 4, and 5 respectively as shown below. An IRQ line is required when the network card needs a service from the PC host. Note that the IRQ line must be different from that of any other add-on card installed in your PC.



Default: IRQ3

Base I/O Address

The first two positions (labeled **I/O**) of 6-position jumper are used to decide the base I/O address as shown below.

J-1	J-2	Base I/O Address
On	On	300H - 31FH
Off	On	320H - 33FH
On	Off	340H - 35FH
Off	Off	360H - 37FH

Default: On On (300H - 31FH)

Remote Boot

The remote boot feature allows a workstation to boot from the network server.

Remote Boot Address

The three-positions (labeled MEM) of 6-position jumper are used to select the base address of remote boot ROM while the remote boot function is enabled.

J-3	J-4	J-5	Boot ROM Address
On	On	On	C000H - C3FFH
Off	On	On	C400H - C7FFH
On	Off	On	C800H - CBFFH
Off	Off	On	CC00H - CFFFH
On	On	Off	D000H - D3FFH
Off	On	Off	D400H - D7FFH
On	Off	Off	D800H - DBFFH
Off	Off	Off	DC00H - DFFFH

Default: On Off On (C800H - CBFFH)

Remote Boot Enabler: J-6

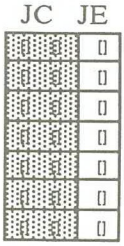
The last position (labeled ROM) of 6-position jumper is used to enable/disable the remote boot feature.

J-6	Remote Boot
On Off	Enable Disable

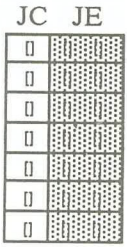
Default: Off (Disable)

Connector Type

The 7-position jumper (labeled JE JC) is used to select what type of connectors to be used. Each Ethernet card mounts both a DIX female connector for connecting to thick cable in Ethernet-configuration network, and a BNC female connector for connecting to thin cable in Cheapernet-configuration network.



(Thin Cabling)

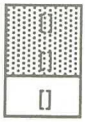


(Thick Cabling)

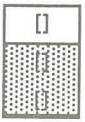
Default: JC (Cheapernet BNC Connector)

AT Bus Compatibility: J1

The 16-bit Ethernet card also contains one 2-position jumper (J1) for AT bus compatibility setting. Some of IBM PC/AT compatible systems are NOT fully timing-compatible with the standard IBM PC/AT bus so that the proper setting of this jumper may be necessary.

A 

IBM PC/AT & compatible systems that are fully timing-compatible with IBM PC/AT bus

B 

Compatible systems that are NOT fully timing-compatible with IBM PC/AT bus

Note

The following is a partial list of PC/AT compatible system that are NOT timing compatible:

- AST Premium 286
- NEC PowerMate 1
- COMPAQ 286 Portable
- Hewlett Packard Model ES 12
- Tandy Model 3000
- PC/AT compatible systems that use the Chips & Technologies or the VLSI chip set

Chapter 3. Installing a Network

An Ethernet network is made up of a main cable, refered to as Trunk Cable, which is used as a common bus line to link many stations together.

The Trunk Cable can consists of several Segments of cable and each Segment must be terminated with a Terminator at both ends.

Each Segment consists of a number of Sections, a Section being defined as the length of cable connecting any two stations.

When planning your network, you must decide the distance between each station, and thus the length of each Section, and purchase individual Sections of cable accordingly. You can also buy one length of Trunk Cable and then cut it according to your network layout, and mount the BNC male connectors on the ends of the Sections of cable.

The segment has a maximum length and a maximum number of nodes it can accommodate. However, you are allowed to install an Ethernet network having more than one segment cable and using a device called Ethernet Repeater for each two segments connected together. The Repeater can be positioned at any point on a segment cable, as long as it is between the two terminators that terminate that segment. Please refer to

the *Ethernet Repeater User's Manual* for detailed information on how to install an Ethernet Repeater.

An Ethernet network can be built into three various types of networks, based on the cables to be used.

- Thin-Cable Network using thin caoxial cable
- Thick-Cable Network using thick coaxial cable
- Combined Thin/Thick-Cable Network using both thin and thick cable on the same network

Thin-Cable Network

A thin-cable network uses the less-expensive thin coaxial cable and BNC-type connectors, and is very easy and flexible to install. To install a thin-cable network, here are the hardware requirements.

- Ethernet card with setting for using BNC connectors
- Thin coaxial cable (RG-58 A/U)
- Tee-connector
- BNC barrel connector (optional)
- BNC terminator
- Ethernet Repeater (optional)

Installation Rules

1. Connect an Ethernet card to the thin cable via a Tee-connector. Do not use any cable between an Ethernet card and the thin cable.

2. Use a BNC barrel connector to connect two lengths of thin cable together. However, the barrel connector should not be used unless necessary since the fewer connections you make in your cable, the more reliable your network will be.

3. A BNC terminator must be installed at each end of each segment.

4. If your planned network length exceeds the maximum length of a segment, an Ethernet Repeater is required. Using Ethernet Repeateres, you may build a single-dimension network, or a complex multi-dimension one. Read the *Ethernet Repeater User's Manual* for details.

5. Minimum disatnce between Tee-connectors: 0.5 meters.

6. Maximum segment cable length: 200 meters

7. Maximum number of segments: 5

8. Maximum network trunk cable length: 1,000 meters

9. Maximum number of nodes per segment: 30 (A Repeater counts as one node on the segment.)

Thick-Cable Network

A thick-cable network uses the more-expensive Ethernet thick coaxial cables, the external transceivers and N-series connectors, and is suitable for long-distance network. To install a thick-cable network, here are their hardware requirements.

- Ethernet card with setting for using N-series connectors
- Thick coaxial cable
- DIX connector
- Transceiver
- Transceiver cable
- N-series barrel connector (optional)
- N-series terminator
- Ethernet Repeater (optional)

Installation Rules

1. Prepare a transceiver and a transceiver cable for each station. Link together the transceivers with lengths of thick cable.

2. Connect the DIX male connector at one end of the transceiver cable to the Ethernet card, and the DIX female connector at the other end of the transceiver cable to the external transceiver.

3. Use an N-series barrel connector to connect two

lengths of thick cable together. However the N-series barrel connector should not be used unless necessary since the fewer connections you make in your cable, the more reliable your network will be.

4. An N-series terminator must be installed at each end of each segment.

5. If your planned network length exceeds the maximum length of a segment, an Ethernet Repeater is required. Using Ethernet Repeaters, you may build a single-dimension network, or a complex multi-dimension one. Read the *Ethernet Repeater User's manual* for details.

6. Minumum distance between transceivers: 2.5 meters
   Maximum transceiver cable length: 50 meters

7. Maximum segment cable length: 500 meters

8. Maximum number of segments: 5

9. Maximum network trunk cable length: 2,500 meters

10. Maximum number of nodes per segment: 100 (A Repeater counts as one node on the segment.)

Combined Thin/Thick-Cable Network

A combined thin/thick-cable network is referred to as an

Ethernet network using both thin cable and thick cable on the same network. To install a combined thin/thick-cable network, the hardware requirements for thin-cable and thick-cable networks described previously should be preserved. It can be created in the following two ways:

- Link a thin-cable network segment to a thick-cable network segment using an Ethernet repeater. Up to five various netowrk segment can be linked together. Each segment must use the same type of cable and connectors.

- Mix the thin cable with the thick cable on the same network segment. To install this type of network segment, you should have BNC to N-series converter.

Installation Rules

1. Follow the thin-cable installation rules for the thin cable part in each network segment.

2. Follow the thick-cable installation rules for the thick cable part in each network segment.

3. Use BNC female to N-series converters to connect thin cable and thick cable together.

4. If more than one segment of cable are to be installed, an Ethernet repeater is required for each two segments connected together.

Appendix Installing the NetWare

This appendix explains how to install the Novell NetWare network operating systems on the 8-bit and 16-bit Ethernet cards.

8-bit Ethernet

The 8-bit Ethernet card is fully compatible with Novell's NE1000 Ethernet interface board at hardware level. While installing the Novell NetWare, use the NE1000 driver for the 8-bit Ethernet card on the file server station or workstation. Please read the appropriate *NOVELL NetWare Installation Manual* for details on NetWare installation.

Please also reference the *NOVELL Ethernet Supplement* for configuration information regarding Interrupt Request Line (IRQ), Base I/O Address and Remote Boot settings.

16-bit Ethernet

The 16-bit Ethernet card is fully compatible with Novell's NE2000 Ethernet interface board at hardware level. While installing the Novell NetWare, use the NE2000 driver for the 16-bit Ethernet card on the file server station or workstation. Please read the appropriate *NOVELL NetWare Installation Manual* for details on NetWare installation.

Please also refer to the *NOVELL Ethernet Supplement* for configuration information regarding Interrupt Request Line (IRQ), Base I/O Address and Remote Boot settings.

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